20
1
531 PCT/DK00/00348
10/019631
27 DEC 2001
International Patent Application No. PCT/DK00/00348
Publication No. WO 01/00522
Mikroelektronik Centret (MIC)
Our ref.: 22769 PC 01

CONFIRMATION COPY

AMENDED CLAIMS, SEPTEMBER 2001

1. A method for providing a substantially periodic pattern, said method comprising the steps of:

- providing a first group of crystalline elements, each of the elements of said first group being formed by the same material and having a predetermined first crystal axis, said first group of crystalline elements defining a substantially plane first surface,

- providing a second group of crystalline elements, each of the elements of said second group being formed by the same material and having a predetermined second crystal axis being different from the first crystal axis, said second group of crystalline elements defining a substantially plane second surface, and

- bringing the first and second group of crystalline elements into contact with each other in such a way that said first surface and said second surface substantially abut each other so as to define an interface region, said periodic pattern extending in said interface region in at least one direction being substantially parallel to said first surface and to said second surface.

2. A method according to claim 1, wherein the material forming the first group of crystalline elements comprises a semiconductor material, such as silicon or gallium arsenide.

3. A method according to claim 1 or 2, wherein the material forming the second group of crystalline elements comprises a semiconductor material, such as silicon or gallium arsenide.

4. A method according to claim 1, wherein the materials forming the first and second group of crystalline elements comprise an insulator material.

5. A method according to any of claims 1-4, wherein the first crystal axis differs from the second crystal axis by a twist angle $\theta$, wherein $\theta$ is within the range 0,1-10°, such as in the range 0,2-9°, such as in the range 0,3-8°, such as in the range 0,5-7°, such as in the range 1-5°.

6. A method according to any of claims 1-4, wherein the first crystal axis differs from the second crystal axis by a tilt angle $\varphi$, wherein $\varphi$ is within the range 0,1-10°, such as in the range 0,2-9°, such as in the range 0,3-8°, such as in the range 0,5-7°, such as in the range 1-5°.

7. An article comprising:

- a first group of crystalline elements, each of the elements of said first group being formed by the same material and having a predetermined first crystal axis, said first group of crystalline elements defining a substantially plane first surface,

- a second group of crystalline elements, each of the elements of said second group being formed by the same material and having a predetermined second crystal axis being different from the first crystal axis, said second group of crystalline elements defining a substantially plane second surface,

wherein the first and second group of crystalline elements are adjacently positioned in such a way that said first surface and said second surface form an interface region between the first and second group of crystalline elements, at least part of said interface region defining a substantially periodic pattern extending in at least one direction being substantially parallel to said first surface and to said second surface.

8. An article according to claim 7, wherein the material forming the first group of crystalline elements comprises a semiconductor material, such as silicon or gallium arsenide.

9. An article according to claim 7 or 8, wherein the material forming the second group of crystalline elements comprises a semiconductor material, such as silicon or gallium arsenide.

10. An article according to claim 7, wherein the materials forming the first and second group of crystalline elements comprise an insulator material.

11. An article according to any of claims 7-10, wherein the first crystal axis differs from the second crystal axis by a twist angle $\theta$, wherein $\theta$ is within the range 0,1-10°, such as in the range 0,2-9°, such as in the range 0,3-8°, such as in the range 0,5-7°, such as in the range 1-5°.

12. An article according to any of claims 7-10, wherein the first crystal axis differs from the second crystal axis by a tilt angle $\varphi$, wherein $\varphi$ is within the range 0,1-10°, such as in the range 0,2-9°, such as in the range 0,3-8°, such as in the range 0,5-7°, such as in the range 1-5°.

13. A laser comprising:

- an article according to any of claims 7-12, the article further comprising:

  - a material or a material system so as to form an array of quantum dots and/or quantum wires at or near the interface region, wherein the further material or material system distributes according to the substantially periodic pattern, and

  - means for providing a pump signal for pumping the material or material system so as to emit electromagnetic radiation.

14. A laser according to claim 13, wherein the material or material system forming the array of quantum dots and/or quantum wires comprises a semiconductor material, such as gallium, arsenide or indium or any combination thereof.

15. A laser according to claim 13 or 14, wherein the material or material system forming the array of quantum dots and/or quantum wires has a thickness smaller than 200 nm, such as smaller than 150 nm, such as smaller than 100 nm, such as smaller than 80 nm, such as smaller than 50 nm.

16. A laser according to any of claims 13-15, wherein the material or material system forming the array of quantum dots and/or quantum wires is overgrown with an additional material, such as silicon or gallium arsenide.

17. A laser according to any of claims 13-16, wherein the pump signal comprises electromagnetic radiation.

18. A laser according to claim 17, wherein the electromagnetic radiation is in the radio frequency, visible or near-infrared range.

19. A laser according to any of claims 13-16, wherein the pump signal comprises a direct and/or alternating electric current.

20. A laser according to any of claims 13-19, wherein the emitted electromagnetic radiation is in the visible or near-infrared range.

21. An object for calibrating an instrument, said object comprising:

- an article according to any of the claims 7-12, wherein the substantially periodic pattern is transferred to a surface of the article.

22. An object according to claim 21, wherein the transferring of the substantially periodic pattern to the surface comprises removing at least part of the first or second group of crystalline elements by etching.

23. An object according to claim 21, wherein the transferring of the substantially periodic pattern to the surface comprises removing at least part of the first or second group of crystalline elements by chemical-mechanical polishing.

24. An object according to claim 21, wherein the transferred substantially periodic pattern is adapted to hold an additional material, such as a metal.

25. An element for splitting an incoming beam into one or more outgoing beams, said element comprising:

- an article according to any of the claims 7-12, wherein the incoming beam is incident on at least part of the substantially periodic pattern, said incoming beam having a first propagating direction, and wherein the one or more outgoing beams are reflected or transmitted by at least part of the substantially periodic pattern in one or more propagation directions being different from the first propagation direction.

26. An object for magnetically storing information, the said object comprising

- an article according to any of the claims 7-12, wherein the substantially periodic pattern is transferred to a surface of the article, said transferred substantially periodic pattern being adapted to hold a plurality of magnetic structures so as to form a plurality of magnetic domains.

27. An object according to claim 26, wherein the plurality of magnetic structures comprise iron, cobalt, chromium or any combination thereof.

28. An object according to claim 26 or 27, wherein the plurality of magnetic structures are arranged according to the substantially periodic structure.

29. An object according to any of claims 26-28, wherein the plurality of magnetic structures are overgrown with a non-magnetic material.